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TITLE OF THE INVENTION

SELF PROPELLED BACKFILLNG APPARATUS

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SELF PROPELLED BACKFILLNG APPARATUS

BACKGROUND OF THE INVENTION

This application claims the benefit of U.S. Application No. 09/498,712 filed on February 7, 2000.

1. Field of the Invention

The present invention relates to heavy equipment used in construction. More particularly, it relates to large earth moving machinery used in trenching and pipeline construction and the device, as herein disclosed, provides extremely accurate user control over the placement of soil and other material used to cover buried pipelines and to backfill structures during heavy construction.

2. Prior Art

Construction projects involving the removal and replacement of soil have been ongoing for thousands of years. Inevitably, construction projects large and small require the exacting removal and repayment of soil in trenches, behind walls, and over pipelines and cables. Placing sand, stone or gravel in a tight area can be one of the most time-consuming and costly tasks at a construction job site. Material may need placement to exacting specifications especially when covering pipelines and other underground utilities. Additionally, there may be concerns about disturbing the surrounding environment by using heavy machinery

to place aggregate materials, should those materials be misplaced by the machine operator. Careful placement of many fill materials is also a must in modern construction since many times pipes, tanks or other under slab materials are damaged using conventional backfilling.

Normally, the gravel, aggregate, soil, or other material to be used for the fill stream arrives and is dumped on the ground and is then loaded into a hopper of the machine which will deposit the fill where it is needed. Depending on the size and access available to the job site, this can take several men and machines many hours to complete. Not only is this an outdated process, but inefficient and costly to project owners and contractors. On large projects such as pipelines, many tons of fill material can be lost in the transferring process, as well as the risk of accidental placement of material improperly or in a fashion that actually damages the pipeline itself.

Consequently, there exists a need for an apparatus which will provide for the easy transport and placement of fill material constantly used in construction projects. Such a device should provide for the easy transportation of the material itself without excessive loss during transport. Additionally, such a device should provide the user an easy manner to place the material according to even the most exacting job specifications.

Further, such a device should also allow the user to accurately place fill material while concurrently avoiding damage during the burying of pipelines, cables, and other infrastructure that is commonly buried. Finally, the device should maintain its own center of gravity to prevent tipping.

SUMMARY OF THE INVENTION

Applicants' device is an easily mounted and operated apparatus capable of use as a complete backfilling unit with material reservoir or hopper for storage and transport of fill material, a conveyor, and a fill material flow director. Or, in some instances, components of the device may be manufactured for mounting and use in combination with existing conveyer systems used in the placement of fill material. The device in the current best mode of a complete unit features a hopper for holding fill material such as gravel, sand, soil, or similar conventionally used materials. The hopper is mounted upon a chassis or support structure of a vehicle that is moveable by conventional wheel and axil or tread mounted systems of propulsion. A telescopic conveyer system is also mounted upon the chassis in a position to receive material from the hopper at one end and convey that material to the distal end for placement in trenches, behind wall, over pipelines, and in similar conventional positions in which fill is required.

In the best mode, at the distal end of the telescopic conveyor, a means for direction of the fill stream is provided by a flow director. However, the combination of the hopper which corrects its own center of gravity with the conveyor by itself is a vast improvement over current technology using a backhoe and dump truck full of dirt. In the best mode, the flow director is attached to the distal end of a conveyor means in this case depicted as a telescopic conveyor belt and constantly receives the fill material transported by the conveyor from the hopper of material on the device. As the conveyor is telescoped in or out, the flow director being attached to the distal end of the conveyor belt support structure is positionable by the machine operator to where fill is to be placed. Attached just below the point where the conveyer belt discharges the fill material carried upon the moving belt, this flow director is always positioned to receive the fill material from the hopper and transported by the conveyor.

The flow director features a pair of channeling ramps connected by an axil to a strut which communicates with the distal end of the support structure for the conveyor belt. The strut provides a mount for one end of each channeling ramp. The distal end of each channeling ramp is independently positionable to an infinite number of positions by a means for elevation of

the channeling ramps in the form of a hydraulic ram. The hydraulic ram is controllable for elongation by the machine operator from the cab in the conventional fashion of such devices. The operator may elongate the ram to raise the attached channeling ramp to change the position of the distal end of the channeling ramp. By changing the position of one or both distal ends of both channeling ramps, the operator gains extremely precise control of the position in which the fill material is placed. Lowering both will provide a narrow but straight stream of material while raising both to the maximum will bifurcate the fill stream and place half of it on one side and the other half of the stream a distance from the first equal to the distance between the two distal ends of the pair of channeling ramps. Optionally, a swivel can be added to the strut allowing the operator to swivel the channeling ramp off the position parallel to the conveyor belt to allow for angled placement of fill.

Additional utility is provided by a means for altering the center of gravity of the hopper. This solves another vexing problem that exists with large machinery which in itself is heavy and becomes even heavier when carrying fill material. Such machines conventionally are prone to tip over when the machine encounters a grade. The means for altering the center of gravity of the hopper allows the user, or a computer, to adjust the

angle of the hopper from a normal position in relation to the frame of the machine to an ever increasing angle, depending on the grade encountered and upon the weight of the fill placed in the hopper. In this case, by using an axil mount at the base of the hopper and a hydraulic ram to tilt the hopper one direction or the other, an infinite number of different positions may be established for the hopper and a resulting number of adjustments of the center of gravity of the assembled machine to traverse the grade encountered.

An object of this invention is providing an easily used and maintained apparatus which provides for extremely accurate placement of fill material on construction sites.

It is a further object of this invention to provide an easily manufactured and operated fill material channeling ramp that may be attached to conventional conveyors when needed as an attachment.

An additional object of this invention is to provide a device allowing for use on steep grades by the adjustment of the center of gravity of the load carried by the device during use.

A further object of this invention is to minimize the waste and misplacement of fill material during backfill and burying of pipelines and underground utilities.

Another object of this invention is to reduce the risk of

damage to an infrastructure such as pipelines and other utilities during the burial phase of their construction.

Further objects of the invention will be brought out in the following part of the specification, wherein detailed description is for the purpose of fully disclosing the invention without placing limitations thereon.

BRIEF DESCRIPTION OF DRAWING FIGURES

Fig 1 is a side view of the device showing the fill material hopper mounted on a powered vehicle with the flow director attached at the distal end of a conveyor belt.

Fig 2 is a side view of the flow director attached at the distal end of a conveyor belt depicting the two channeling ramps adjusted for placement of fill material.

Fig 3 is a side view of the conveyor with the channeling ramps in a retracted position for a narrow pour of the bifurcated material stream.

Fig 4 depicts the independently adjustable channeling ramps in unequal positions to bifurcate the fluid stream unevenly.

Fig 5 depicts a side view of the self powered vehicle on an incline with the hopper adjusted to change the vehicle center of gravity.

Fig 6 depicts and additional preferred embodiment of the device with fixed or extendable conveyors which can be positioned to deposit fill when a bifurcated material stream is not needed and with a conveyor that can optionally be raised or lowered.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS OF THE INVENTION

Referring now to the drawing Figures 1-6 depict the various components and interrelation thereof in operation of the disclosed device **10.** Figure 1 depicts a side view of the device **10** as it would appear in operation as a complete unit. While it is anticipated that components of the device **10** can be manufactured as attachments to conventionally used back filling devices, the current best mode of the device **10** works best as a complete unit with a hopper **12** for holding and transporting fill material, a conveyor means such as the depicted telescopic conveyor **20**, and a material stream flow director **14**, functioning in a symbiotic relationship to each other.

The device **10** in the current best mode of a complete unit features a hopper **12** which is filled by the user with one or combinations of conventional fill materials such as gravel, sand, soil, or similar conventionally used materials. The hopper **12**

is mounted upon an attachment point depicted in this case as the hopper axil **46** to the vehicle chassis **16** of a powered or self propelled vehicle **18.** The self propelled vehicle **18** may be powered by conventional means for vehicle power such as gasoline or diesel engines which provide power via communicating hydraulic pumps or by drive shafts communicating the power to wheels and pump combinations or in other conventional means of powering a wheeled or treaded or similar such piece of construction equipment.

A conveyor means depicted by a telescopic conveyor **20** is also mounted upon the chassis **16** by a support structure **26** which defines the dimensions of the conveyor **20** built around it. The conveyor means could also be a fixed length conveyor but in the current best mode the conveyor means is a telescopic conveyor **20** and provides the most utility. This is because it is adjustable for positioning the distal end of the conveyor **20** and the flow of fill material **22** leaving that end, at the location desired for deposit of the material **22.** Since the receiving point for the fill material **22** is generally in trenches, behind walls, over pipelines, on top of power lines, gas pipes, and other infrastructure utilities that are buried, adjustability in the form of the telescopic conveyer **20** provides the user greater

adjustability for the flow of fill material **22** to the desired location. With more effort, a fixed length conveyor could also be used but the telescopic conveyor **20** is the current best mode.

The conveyer **20** works in the conventional manner of conveyer belt systems and transports fill material **22** communicated from the hopper **12** at the receiving end **23**, and conveys that material **22** on a rotating belt **21** to the distal end **24** for placement in desired location. The belt would be powered by a conventional means for powering the rotation of the belt such as a hydraulicly powered motor or electric motor. At the distal end **24** of the conveyer **20** a means for adjustably bifurcating a communicated stream of fill material is provided by the flow director **14**. The flow director is attached to the distal end **24** of the conveyor means in this case conveyor **20** in a position to constantly receive substantially all of the fill material **22** communicated by the conveyer **20** from receiving end **23** which receives fill from a discharge aperture **11** operatively position in the hopper **12**. If mounted to the conveyor **20** which is of fixed length, the flow director **14** remains fixed in position relative to the ground attached to the distal end **24** of the conveyor **20**. This would be acceptable in instances when access to the target for the fill stream is easily obtained and maintained. When mounted to the

distal end **24** of a conveyor **20** that is telescopic, when the conveyer **20** is telescoped and laterally translates, the location in relation to the ground of the fill material flow director **14** is easily positionable by the machine operator over the target position where fill material **22** is to be placed. The flow director **14** would be attached to the support structure **26** for the conveyer **20** just below a point at the distal end **24** where the conveyer **20** discharges the fill material **22** which has been communicated by the conveyor belt from the discharge aperture **11** in the wall of the hopper **12**.

The flow director **14** features a pair of channeling ramps **28** which are connected at a first end **29** of each of the ramps **28** by a ramp axil **30** in a position adjacent to the distal end **24** of the conveyor **20** at a strut **32** or other fixed member which is part of, or communicates with, the distal end **24** of the support structure **26** for the conveyer **20**. As depicted in the current best mode, the strut **32** provides a mount for the first end of each channeling ramp **28** but other means of attachment to the distal end of the conveyor **20** are anticipated.

The distal end **34** of each channeling ramp **28** opposite the first ends attached at the ramp axil **30**, are each independently positionable, to an infinite number of positions from their low

point determined by the minimum length of the hydraulic ram **36**, which rotates them on the ramp axil **30** as depicted in figure 3, and the high point of elevation of the distal ends **34** depicted in figure 2, as determined by the maximum extension of the ram **36**, which rotates them on the ramp axil **30**. The operator by elongating the ram **36** using conventional controls, may change the position of each of the two different distal ends **34** independently to adjust the landing point for the material stream discharged from that distal end **34**. Changing the positions of the ramps **28** thus provides a means to direct each of two separated material streams to a separate individual target position below the distal end of said conveyor **20**. This allows the user to take the bifurcated material stream and direct two separate streams of material to a bury a target to be covered on the ground, such as a pipe or trench, by a means for independent elevation of each of the channeling ramps **28** in the form of a hydraulic ram **36**. Electric solenoids or rack and pinion gear mechanisms might also be used to provide the means for independent elevation of the channeling ramps **28**, however, the current best mode uses hydraulic rams **36** since the majority of heavy equipment of this type are powered by on board hydraulic systems which also provide power for the conveyor **20** and self propulsion using treads **50**

receiving power from a hydraulic motor. The hydraulic ram **36** is controllable for elongation and contraction by the machine operator from the cab of the powered vehicle **13** in the conventional fashion of such devices which have a laterally translatable arm moving in and out of a cylinder. The engine providing propulsion by powering the hydraulic pumps or electric motors would be operatively mounted to the chassis of the vehicle **13** in a position to allow operative communication with the control levers in the cab **15** which allow the operator to control the various functions powered by the engine. The operator may elongate the ram **36** to raise the attached channeling ramp **28** and thus change the position of the distal end **34** of the channeling ramps **28**, or he can shorten the ram **36** to lower the ramps **28**. Each ram **36** is independently adjustable to thereby swing the attached channeling ramp **28** on the ramp axil **30**. The user can thus independently adjust the position from the low point or the center axis of trench or pipe or other item to be buried by adjustment of one or both distal ends **34** of both channeling ramps **28** from centerline between the low point of adjustment. The operator can thereby control the deposit position and quantity of fill material deposited from each of the two parts of the bifurcated stream of fill material **22** being split. This

individual adjustment of quantity of fill material so deposited provides the operator extremely precise control of the position and quantity at which the fill material **22** communicated to the flow director **14** by the conveyor **20** is placed. Lowering both channeling ramps **28** to the low point where the distal ends of each channeling ramp are substantially adjacent to each other will move the distal ends of the channeling ramps **28** over to the center axis of the trench or pipe or other item being buried, and provide a narrow but straight directional stream of fill material **22** to a single point. Conversely, raising both channeling ramps **28** to the highpoint or maximum position essentially perpendicular to the center axis of the pipe or trench, will move the distal ends of the channeling ramps further away from the center line and will bifurcate the communicated stream of fill material **22** to a maximum distance from center line of the trench, pipe, or other object being covered with fill.

Adjusting the angles of the ramps **28** also provide a means adjustably bifurcating the volume of the two separate streams of fill material and thereby allows the operator to place a defined amount of fill material **22** in one location at the narrowest point of separation of the distal ends, or defined amounts of the communicated fill material **22** in two different target locations.

Since both of the channeling ramps **28** are independently adjustable, there is an infinite number of positions for the distal ends **34** of the channeling ramps **28** in relation to each other and the center line of the object being buried by the fill material thus allowing for an infinite number of adjustments of the quantity, as well as the target location of each section the streams of fill material being deposited. Further means of adjustingly bifurcating the amounts of each of the two streams of fill material being deposited is accomplished by using remote controls for slowing, or speeding the rate of forward speed of the belt **21** toward the distal end of the conveyor **20.** By adjusting the motor that runs the conveyor and thus the speed of the conveyor belt **21** the amount of fill material deposited on one or the other of the channeling ramps **28** can also be adjusted. This results because a faster speed of the belt **21** conveyer **20** will produce more inertia on the fill material and naturally cause more material to be deposited further away from the conveyer distal end **24** causing more fill material **22** to deposit on the outer channeling ramp **28.** Conversely slowing the speed of the conveyer **20** will cause an equal distribution to each of the pair of channeling ramps **28** with an even slower belt speed causing more material to deposit on the closest of the ramps to

the distal end of the conveyor **20**, and less on the outer channeling ramp **28**.

Since the flow of material can also be adjusted by resistance provided by gravity in relation to the upward angle on the channeling ramps **28**, the user can also adjust the flow and volume of the two separate streams of material **22** by increasing or decreasing the downward angle of the channeling ramps **28** in relation to a position normal to the angle of the conveyor **20**. A steeper angle will cause less back pressure on the steam of fill material falling onto the ramps **28** causing a faster fall and more material flowing down that ramp. A less steep angle will cause the material to stay upon the channeling ramps **28** slightly longer due to friction caused by gravity on the fill and thereby cause back pressure in the flow of the material resulting in less material reaching the designated position. By adjusting the channeling ramps **28** to different individual angles, the operator can precisely deposit more or less fill material to the desired target from each of the channeling ramps **28** causing more fill material to be deposited from one ramp **28** than the opposite ramp **28**. Combinations of these different means for adjustingly bifurcating the flow and thus the volume of deposited fill material can be achieved by combining one or combinations of the

aforementioned speed control of the conveyor **20** and the angle of the channeling ramps **27** and **28**.

This ability to deposit fill material precisely on target and in precise volume, is especially important in the backfill operation involving pipelines and other trench buried infrastructures. The aforementioned means for adjustably bifurcating the stream of fill material, and the means to direct each of the two separated material streams to an individual target position below said distal end of said conveyor allow increased precision as depicted in figures 2-5. As depicted, each of the channeling ramps 27 and 28 have been adjusted to a downward angle to yield the precise volume of material **22** to be deposited in the precise target position on below the distal end of the conveyor **20** on either side of the centerline of the trench being filled, or, on adjacent sides of an object such as a pipeline **42** or in a back fill of a wall **48** or in other targeted positions for the separated fill streams. By adjusting the position of the flow director **14** by laterally translating the telescopic conveyor **20** and adjusting the angles and elevation of the individual channeling ramps **28** appropriately, the operator avoids damage to the pipe **42** which could be caused by dropping fill material from the conveyor **20**

directly onto the pipe **42** or onto the pipe **42** at the wrong angle or from the wrong elevation. The ability to adjust each channeling ramp **28** independently of the other as depicted in figure 4, allows the operator to deposit an exact volume of material **22** on each side of the pipe **42** to bury and protect it. Individual adjustment of the channeling ramps **28** to equal or differing distances from a center line allows more or less fill material to be deposited by one or the other of the channeling ramps **28** on either side of a target.

Additional means for steering the placement of fill material is provided the operator by a control allowing the operator to change the speed of the conveyor **20** or the angle of one or both of the channeling ramps **28** and the position of the flow director over the target to be buried, all at the same time. This allows the operator a constant ability and means of steering the placement of the fill material **22** as well as a means for determining the volume of material **22** placed in one or a plurality of positions of the two separate material streams.

The conveyor **20** if powered by conventional hydraulic systems which as noted above can be sped up or slowed in the conventional fashion using levers to change the flow rate of the hydraulic fluid powering the motors **25**. Or, if an electric motor is

instead used as a means to rotate the conveyor belt **21** on the conveyor **20** its speed can be increased or decreased in a conventional manner using electrical controls such as a potentiometer to control the speed of the electric motor which would communicate power to the belt **20** to rotate it.

Optionally, additional means for adjustment of the placement of the bifurcated material stream may be provided by a swivel **44** at the attachment point of the flow director **14** to the distal end of the conveyor **20.** Such an option would allow the operator to swivel the channeling ramps **28** to positions off the position parallel to the conveyor **20** to allow for angled placement of fill **22** discharged by the distal ends of the channeling ramps **28.** The swivel **44** can be hydraulically driven by a hydraulic motor **25** or gear driven, or electrically driven, in the aforementioned conventional manner of powering such construction equipment.

Additional utility is provided by an optional means for altering the center of gravity of the hopper **12.** This ability to adjust the massive weight imparted to the vehicle **12** by the load of fill material **22** deposited in the hopper **12** solves another vexing problem that exists with large machinery. Such machines, due to their mass and odd center of gravity caused by irregular shape and operational configurations, are prone to tip over when

the machine encounters a steep grade. The means for altering the center of gravity of the hopper **12** allows the user, or a computer, to adjust the angle of the hopper **12** from normal to the vehicle **13** frame to a better angle, depending on the grade encountered and upon the weight of the fill **22** placed in the hopper **12**.

As depicted in figure 5, a means for adjustment of the vehicle center of gravity is provided by the hopper being attached to the vehicle chassis at an attachment point having a hopper axil **46** which rotationally attaches the hopper **12** to the chassis **16** of the powered vehicle **13**. The axil **46** is situated at the base of the hopper **12** thus allowing the entire hopper **12** to rotate on the axil **46** at the connection point to the vehicle **13**. A means to tilt the hopper **12** which in this case is a hydraulic ram **36** of the same operation as mentioned above. However, other devices such as rack and pinion gearing, or electric solenoids could be used if desired or on vehicles so powered.

The operator, or a computer, tracking the incline traversed by the vehicle **13** and the mass of the fill material **22** carried in the hopper **12** can therein tilt the hopper **12** one direction or the other by rotating the hopper **12** on the hopper axil **46** to an infinite number of different positions between the position of

the hopper on level ground normal to the vehicle chassis **16** and the maximum radius or degree of rotation of the container on the hopper axil **46.** By changing the angle of the hopper **12** from a position normal to the chassis **16,** the operator changes the center of gravity of the entire vehicle **18** since the force of the mass of the hopper is imparted to the vehicle **18** at the connection point where the chassis **16** provides the mount for the hopper axil **46.** By altering the angle of the hopper **12,** the operator is able to traverse road surfaces of much greater incline than can be achieved without the means for altering the vehicle's center of gravity. Such an ability allows the operator to use the vehicle **18** without fear of roll over that would occur in vehicles without this ability to change the center of gravity.

While the best mode of the device herein disclosed is as a single unit with the hopper **12** having a means to adjust the center of gravity of the attached vehicle **13** and combined with the flow director **14** mounted to the end of the conveyor **20,** it is possible that the flow director could be made attachable to existing conveyors already in use and such a use is anticipated. Attaching the flow director to existing conveyors which lack any means to bifurcate or control the volume of material being deposited would significantly enhance such devices.

Consequently the flow director **14** can be configured with a means of attachment to a conventional conveyor already in use to provide the utility described above and to thereby increase the effectiveness, accuracy and speed of such conventional conveyors in depositing fill material on designated targets. Such a use is anticipated due to the huge increase in utility attaching the flow director **14** by itself to retrofit existing conveyors and conveyor systems on such vehicles currently in use.

Figure 6 depicts and additional preferred embodiment of the device which takes advantage of the extendable conveyors **20** which as noted working in the conventional fashion of a conveyor belt and convey fill material **22** communicated from the hopper **12** at the receiving end **23** and transport the fill material **22** on a rotating belt **21** to the distal end **24** of the conveyor **20**. The belt **21** would be powered by a conventional means for powering the rotation of the belt such as a hydraulicly powered motor or electric motor. The distal end **24** of the conveyer **20** in this case would not have the flow director **14** and would deposit the material **22** on top of or on the adjacent sides of the pipe **42** or other structure in the trench to be buried. This embodiment, while not yielding all of the benefits of the embodiment with the flow director **14** does offer a substantial improvement over the

conventional manner of filling a trench which involves the use of a mechanical shovel or backhoe which picks up buckets of dirt or fill material **22** and simply drops it in the trench.

Another preferred embodiment of figure 6 while simpler in nature, still provides a vast improvement over the current method of backhoes and piles of dirt. In this embodiment, the conveyor **20** would have first and second conveyor belts **21** with the distal end **24** being laterally translateable in relation to the receiving end **23** which would receive material from the vehicle mounted and adjustable hopper **12** thereby providing a means to telescope the conveyer **20** to longer or shorter lengths to position the distal end **24** over the area to be filled. Thus, the second conveyer belt **21** would receive fill material **22** from the first conveyor belt **21** deposited there from the hopper **12** on the receiving end **23.** The second conveyor belt **21** of the conveyor **20** would render the distal end **24** user positionable over the center or sides of the trench by laterally translating the distal end **24** to the appropriate position to deposit fill material **22** in the desired location. This lateral translation of the second conveyor belt **21** under the first conveyor belt **21** would be accomplished using hydraulic cylinders **36** or similar conventional means. Of course the conveyor **20** might be comprised of a single conveyor belt **21**

which could laterally translate, the current best mode features a pair of conveyor belts **21** with the distal end **24** being on the conveyor belt **21** furthest from the hopper **12** and being laterally translateable. Optionally, the distal end **24** would also be adjustable for elevation using a means for adjustment of the elevation of the distal end **24** in the form of a conventional hydraulic cylinder **36** or similar controllable extension device to adust the height of the distal end **24** above the trench by rotating the entire conveyor **20** at its connection below hopper **12** on the chassis **16**.

The conveyor **20**, using the vehicle mounted hopper **12** which itself is adjustable as noted above as a means to change the center of gravity of the vehicle for inclines, and the speed of the conveyor belts **21**, as well as the elevation of the distal end **24** and the laterally translated position of the distal end **24**, can all be combined and adjusted by the user to place the fill material **22** in the desired position in the trench. Thus, use of the telescoping or single piece conveyor **20**, and optional elevation adjustment thereof, attached to the tiltable vehicle mounted hopper **12**, provides a major increase in utility of trench filling over the aforementioned conventional manner of placing fill material **22** in a trench using a backhoe or similar shovel

device.

While all of the fundamental characteristics and features of the self propelled backfilling apparatus with controllable steering of fill material stream invention have been shown and described, it should be understood that various substitutions, modifications, and variations may be made by those skilled in the art without departing from the spirit or scope of the invention. Consequently, all such modifications and variations are included within the scope of the invention as defined by the following claims.